
24 CFR Part 51
Subpart C

Siting of HUD-Assisted Projects Near Hazardous Operations Handling Conventional Fuels or Chemicals of an Explosive or Flammable Nature.

Effective Date April 25, 1996

Authority: Sec. 2, Housing Act of 1949 (42 U.S.C. 1441); sec. 7 (d), Department of Housing and Urban Development Act (42 U.S.C. 3535 (d)); sec. 2, Housing and Urban Development Act of 1969 (42 U.S.C. 1441 (a)).

Source: 49 FR , Feb. 10, 1984, p 5100-5108; March 20, 1984, p 10253; March 29, 1984, p 12214; 61 FR p 13332 – 13335 March 26, 1996.

51.200 Purpose

The purpose of this subpart C is to:

- (a) Establish safety standards which can be used as a basis for calculating acceptable separation distances (ASD) for HUD-assisted projects from specific, stationary, hazardous operations which store, handle, or process hazardous substances;
- (b) Alert those responsible for the siting of HUD-assisted projects to the inherent potential dangers when such projects are located in the vicinity of such hazardous operations;
- (c) Provide guidance for identifying those hazardous operations which are most prevalent;
- (d) Provide the technical guidance required to evaluate the degree of danger anticipated from explosion and thermal radiation (fire); and
- (e) Provide technical guidance required to determine acceptable separation distances from such hazards.

51.201 Definitions.

Acceptable separation distances (ASD) – means the distance beyond which the explosion or combustion of a hazard is not likely to cause structures or individuals to be subjected to blast overpressure or thermal radiation flux levels in excess of the safety standards in §51.203. The ASD is determined by applying the safety standards established by this subpart C to the guidance set forth in HUD Guidebook, "Siting of HUD-Assisted Projects Near Hazardous Facilities."

Blast overpressure – means the pressure, in pounds per square inch, in excess of normal atmospheric pressure on the surrounding medium caused by an explosion.

Danger zone – means the land area circumscribed by the radius which delineates the ASD of a given hazard.

Department – means the Department of Housing and Urban Development (HUD).

Hazard – means any stationary container which stores, handles or processes hazardous substances of an explosive or fire prone nature. The term "hazard" does not include pipelines for the transmission of hazardous substances, if such pipelines are located underground or comply with applicable Federal, State and local safety standards. Also excepted are: (1) Containers with a capacity of 100 gallons or less when they contain common liquid industrial fuels, such as gasoline, fuel oil, kerosene and crude oil since they generally would pose no danger in terms of thermal radiation of blast overpressure to a project; and (2) facilities which are shielded from a proposed HUD-assisted project by the topography, because these topographic features effectively provide a mitigating measure already in place.

Hazardous substances – means petroleum products (petrochemicals) and chemicals that can produce blast overpressure or thermal radiation levels in excess of the standards set forth in §51.203. A specific list of hazardous substance is found in appendix I to this subpart.

HUD-assisted project – the development, construction, rehabilitation, modernization or conversion with HUD subsidy, grant assistance, loan, loan guarantee, or mortgage insurance, of any project which is intended for residential, institutional, recreational, commercial or industrial use. For purposes of this subpart the terms "rehabilitation" and "modernization" refer only to such repairs and renovation of a building or buildings as will result in an increased number of people being exposed to haz-

ardous operations by increasing residential densities, converting the type of use of a building to habitation, or making a vacant building habitable.

Secretary – means the Secretary of Housing and Urban Development.

Thermal radiation level – means the emission and propagation of heat energy through space or a material medium, expressed in BTU per square foot per hour (BTU/ft.² hr.).

51.202 Approval of HUD-assisted projects.

(a) The Department will not approve an application for assistance for a proposed project located at less than the acceptable separation distance from a hazard, as defined in §51.201, unless appropriate mitigating measures, as defined in §51.205, are implemented, or unless mitigating measures are already in place.

(b) In the case of all applications for proposed HUD-assisted projects, the Department shall evaluate projected development plans in the vicinity of these projects to determine whether there are plans to install a hazardous operation in close proximity to the proposed project. If the evaluation shows that such a plan exists, the Department shall not approve assistance for the project unless the Department obtains satisfactory assurances that adequate mitigating measures will be taken when the hazardous operation is installed.

51.203 Safety standards.

The following standards shall be used in determining the acceptable separation distance of a proposed HUD-assisted project from a hazard:

(a) Thermal Radiation Safety Standard. Projects shall be located so that:

(1) The allowable thermal radiation flux level at the building shall not exceed 10,000 BTU/sq. ft. per hr.;

(2) The allowable thermal radiation flux level for outdoor, unprotected facilities or areas of congregation shall not exceed 450 BTU/sq. ft. per hour.

(b) Blast Overpressure Safety Standard. Projects shall be located so that the maximum allowable blast overpressure at both buildings and outdoor, unprotected facilities or areas shall not exceed 0.5 psi.

(c) If a hazardous substance constitutes both a thermal radiation and blast overpressure hazard, the ASD for each hazard shall be calculated, and the larger of the two ASDs shall be used to determine compliance with this subpart.

(d) Background information on the standards and the logarithmic thermal radiation and blast overpressure charts that provide assistance in determine acceptable separation distances are contained in Appendix II to subpart C.

51.204 HUD-assisted hazardous facilities.

In reviewing applications for proposed HUD-assisted projects involving the installation of hazardous facilities, the Department shall ensure that such hazardous facilities are located at an acceptable separation distance from residences and from any other facility or area where people may congregate or be present. The mitigating measures listed in §51.205 may be taken into account in determining compliance with this section.

51.205 Mitigating measures.

Application of the standards for determining an Acceptable Separation Distance (ASD) for a HUD-assisted project from a potential hazard of an explosion or fire prone nature is predicated on level hazard of an explosion or fire prone nature is predicated on level topography with no intervening object(s) between the hazard and the project. Application of the standards can be eliminated or modified if:

(a) The nature of the topography shields the proposed project from the hazard.

(b) An existing permanent fire resistant structure of adequate size and strength will shield the proposed project from the hazard.

(c) A barrier is constructed surrounding the hazard, at the site of this project, or between the potential hazard and the proposed project.

(d) The structure and outdoor areas used by people are designed to withstand blast overpressure and thermal radiation anticipated from the potential hazard (e.g., the project is of masonry and steel or reinforced concrete and steel construction).

51.206 Implementation.

This subpart C shall be implemented for each proposed HUD-assisted project by the HUD approving official or responsible entity responsible for review of the project. The implementation procedure will be part of the environmental review process in accordance with the procedures set forth in 24 CFR part 50 and 24 CFR part 58. (49 FR 5103, Feb. 10, 1984; 49 FR 10253, Mar. 20, 1984)

51.207 Special Circumstances.

The Secretary or the Secretary's designee may, on a case-by-case basis, when circumstances warrant, require the application of this subpart C with respect to a substance not listed in appendix I to this subpart C that would create thermal or over-pressure effect in excess of that listed in §51.203.

51.208 Reservation of administrative and legal rights.

Publication of these standards does not constitute a waiver of any right: (a) Of HUD to disapprove a project proposal if the siting is too close to a potential hazard not covered by this subpart, and (b) of HUD or any person or other entity to seek to abate or to collect damages occasioned by a nuisance, whether or not covered by the subpart.

Specific Hazardous Substances

Specific Hazardous Substances. The following is a list of specific petroleum products and chemicals defined to be hazardous substances under §51.201.

Hazardous Liquids

Acetic Acid	Crude Oil (Petroleum)	Isobutyl Alcohol
Acetic Anhydride	Cumene	Isopropyl Acetate
Acetone	Cyclohexane	Isopropyl Alcohol
Acrylonitrile	No. 2 Diesel Fuel	Jet Fuel and Kerosene
Amyl Acetate	Ethyl Acetate	Methyl Alcohol
Amyl Alcohol	Ethyl Acrylate	Methyl Amyl Alcohol
Benzene	Ethyl Alcohol	Methyl Cellosolve
Butyl Acetate	Ethyl Benzene	Methyl Ethyl Ketone
Butyl Acrylate	Ethyl Dichloride	Naptha
Butyl Alcohol	Ethyl Ether	Pentane
Carbon Bisulfide	Gasoline	Propylene Oxide
Carbon Disulfide	Heptane	Toluene
Cellosolve	Hexane	Vinyl Acetate
Cresols	Isobutyl Acetate	Xylene

Hazardous Gases

Acetaldehyde	Ethylene	Liquefied Petroleum Gas (LPG)
Butadiene	Ethylene Oxide	Propane
Butane	Hydrogen	Propylene
Ethene	Liquefied Natural Gas (LNG)	Vinyl Chloride

(Primary Source: "Urban Development Siting with Respect to Hazardous Commercial/Industrial Facilities," by Rolf Jensen and Associates, Inc., April 1982).



Explosion Affecting an Urban Area.

Note: The fire ball exceeds the height of the 120 foot water tower.

Development of Standards; Calculation Methods

I. Background Information Concerning the Standards**(a) Thermal Radiation**

(1) **Introduction.** Flammable products stored in above ground containers represent a definite, potential threat to human life and structures in the event of fire. The resulting fireball emits thermal radiation which is absorbed by the surroundings. Combustible structures, such as wooden houses, may be ignited by the thermal radiation being emitted. The radiation can cause severe burn, injuries and even death to exposed persons some distance away from the site of the fire.

(2) **Criteria for Acceptable Separation Distance (ASD).** Wooden buildings, window drapes and trees generally ignite spontaneously when exposed for a relatively long period of time to thermal radiation levels of approximately 10,000 BTU/hr. sq. ft. It will take 15 to 20 minutes for a building to ignite at that degree of thermal intensity. Since the reasonable response time for fire fighting units in urbanized areas is approximately five to ten minutes, a standard of 10,000 BTU/hr. sq. ft. is considered an acceptable level of thermal radiation for buildings.

People in outdoor areas exposed to a thermal radiation flux level of approximately 1,500 BTU/ft² hr will suffer intolerable pain after 15 seconds. Longer exposure causes blistering, permanent skin damage, and even death. Since it is assumed that children and the elderly could not take refuge behind walls or run away from the thermal effect of the fire within the 15 seconds before skin blistering occurs, unprotected (outdoor) areas, such as playgrounds, parks, yards, school grounds, etc., must be placed at such a distance from potential fire locations so that the radiation flux level is well below 1500 BTU/ft² hr. An acceptable flux level, particularly for elderly people and children, is 450 BTU/ft² hr. The skin can be exposed to this degree of thermal radiation for 3 minutes or longer with no serious detrimental effect. The result would be the same as a bad sunburn. Therefore, the standard for areas in which there will be exposed people, e.g. outdoor recreation areas such as playgrounds and parks, is set at 450 BTU/hr. sq. ft. Areas covered also include open space ancillary to residential structures, such as yard areas and vehicle parking areas.

(3) **Acceptable Separation Distance From a Potential Fire Hazard.** This is the actual setback required for the safety of occupied buildings and their inhabitants, and people in open spaces (exposed areas) from a potential fire hazard. The specific distance required for a safety from such a hazard depends upon the nature and the volume of the substance. The Technical Guidebook entitled "Urban Development Siting With Respect to Hazardous/Commercial Industrial Facilities," which supplements this regulation, contains the technical guidance required to compute Acceptable Separation Distances (ASD) for those flammable substances most often encountered.

(b) Blast Overpressure

The Acceptable Separation Distance (ASD) for people and structures from materials prone to explosion is dependent upon the resultant blast measured in pounds per square inch (psi) overpressure. It has been determined by the military and corroborated by two independent studies conducted for the Department of Housing and Urban Development that 0.5 psi is the acceptable level of blast overpressure for both buildings and occupants, because a frame structure can normally withstand that level of external exertion with no serious structural damage, and it is unlikely that human beings inside the building would normally suffer any serious injury. Using this as the safety standard for blast overpressure, nomographs have been developed from which an ASD can be determined for a given quantity of hazardous substance. These nomographs are contained in the handbook with detailed instructions on their use.

(c) Hazard evaluation

The Acceptable Separation Distances for buildings, which are determined for thermal radiation and blast overpressure, delineate separate identifiable danger zones for each potential accident source. For some materials the fire danger zone will have the greatest radius and cover the largest area, while for others the explosion danger zone will be the greatest. For example, conventional petroleum fuel products

stored in unpressurized tanks do not emit blast overpressure of dangerous levels when ignited. In most cases, hazardous substances will be stored in pressurized containers. The resulting blast overpressure will be experienced at a greater distance than the resulting thermal radiation for the standards set in section 51.203. In any event the hazard requiring the greatest separation distance will prevail in determining the location of HUD-assisted projects.

The standards developed for the protection of people and property are given in the following table.

	Thermal Radiation	Blast Overpressure
Amount of acceptable exposure allowed for building structures	10,000 BTU/ft ² hr	0.5 psi
Amount of acceptable exposure allowed for people in open areas	450 BTU/ft ² hr	0.5 psi

Problems Example:

The following example is given as a guide to assist in understanding how the procedures are used to determine an acceptable separation distance. The technical data are found in the HUD Guidebook. Liquid propane is used in the example since it is both an explosion and a fire hazard.

In this hypothetical case a proposed housing project is to be located 850 feet from a 30,000 gallon liquid propane (LPG) tank. The objective is to determine the acceptable separation distance from the LPG tank. Since propane is both explosive and fire prone it will be necessary to determine the ASD for both explosion and for fire. The greatest of the two will govern. There is no dike around the tank in this example.

Nomographs from the technical Guidebook have been reproduced to facilitate the solving of the problem.

ASD for Explosion:

Use Figure 1 to determine the acceptable separation distance for explosion.

The graph depicted on Figure 1 is predicated on a blast overpressure of 0.5 psi.

The ASD in feet can be determined by applying the quantity of the hazard (in gallons) to the graph.

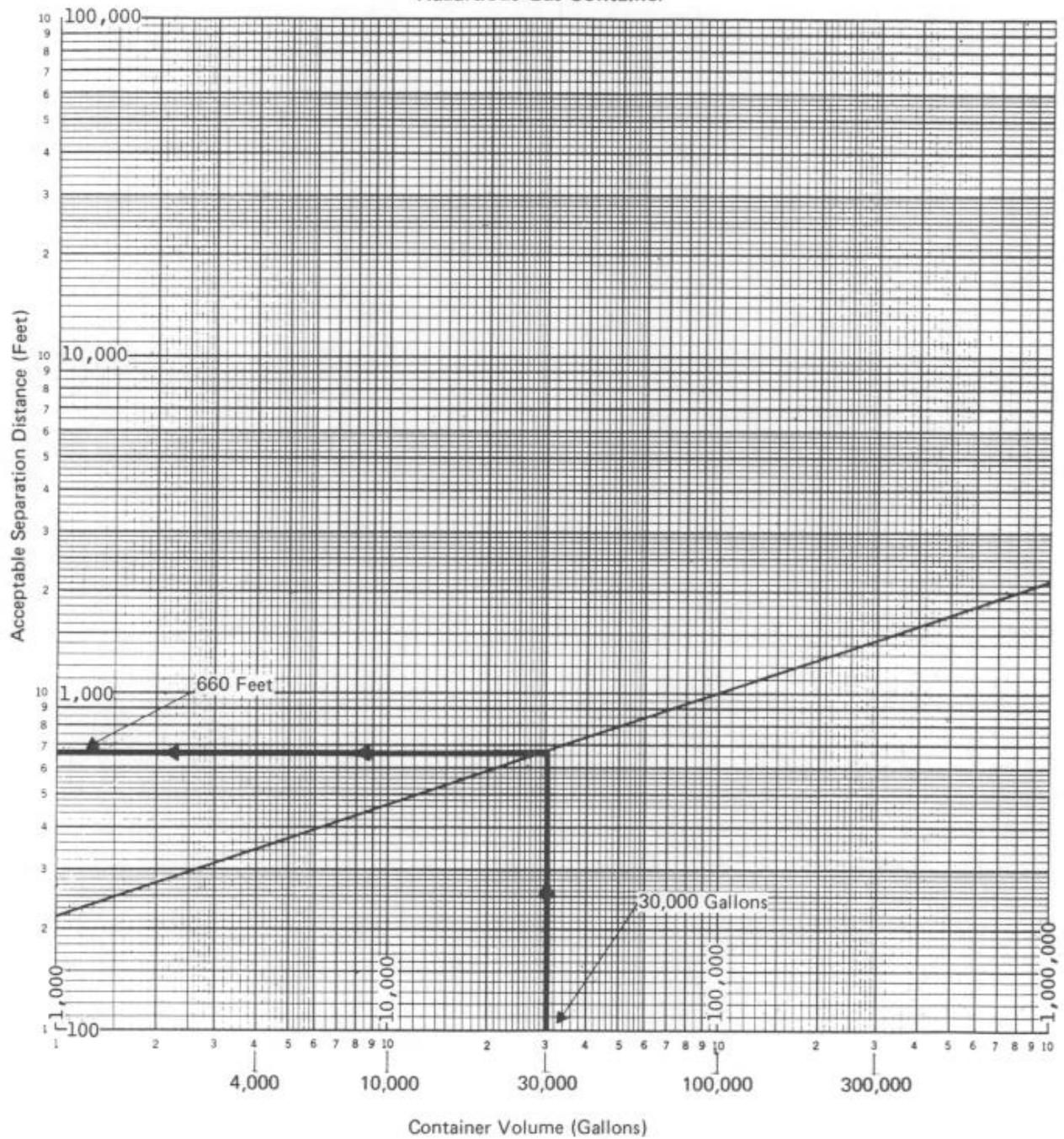
In this case locate the 30,000 gallon point on the horizontal axis and draw a vertical line from the point to the intersection with the straight line curve. Then draw a horizontal line from the point where the lines cross to the left vertical axis where the **Acceptable Separation Distance** of 660 feet is found.

Therefore the ASD for explosion is 660 feet.

Since the proposed project site is located 850 feet from the tank it is located at a safe distance with regards to blast overpressure.

Acceptable Separation Distance
Blast Overpressure
(No Blast Barriers)
Hazardous Gas Container

Figure 1



ASD for Fire:

To determine the ASD for fire it will be necessary to first find the fire width (diameter of the fireball) on Figure 2. Then apply this to Figure 3 to determine the ASD.

Since there are two safety standards for fire: (a) 10,000 BTU/ft² hr. for buildings; and (b) 450 BTU/ft² hr. for people in exposed areas, it will be necessary to determine an ASD for each.

To determine the fire width locate the 30,000 gallon point on the horizontal axis on *Figure 2* and draw a vertical line to the straight line curve. Then draw a horizontal line from the point where the lines cross to the left vertical axis where the **Fire Width** is found to be *350 feet*.

Now locate the 350 ft. point on the horizontal axis of *Figure 3* and draw a vertical line from that point to curves 1 and 2. Then draw horizontal lines from the points where the lines cross to the left vertical axis where the **Acceptable Separation Distances** of *240 feet* for buildings and *1150 feet* for exposure to people is found.

Based on this the proposed project site is located at a safe distance from a potential fireball. However, exposed playgrounds or other exposed areas of congregation must be at least 1150 feet from the tank, or be appropriately shielded from a potential fireball.

(Source: HUD Handbook, "Urban Development Siting With Respect to Hazardous Commercial/Industrial Facilities.")

Fire Width - Unconfined Spill
Hazardous Gas Container
Not Diked

Figure 2

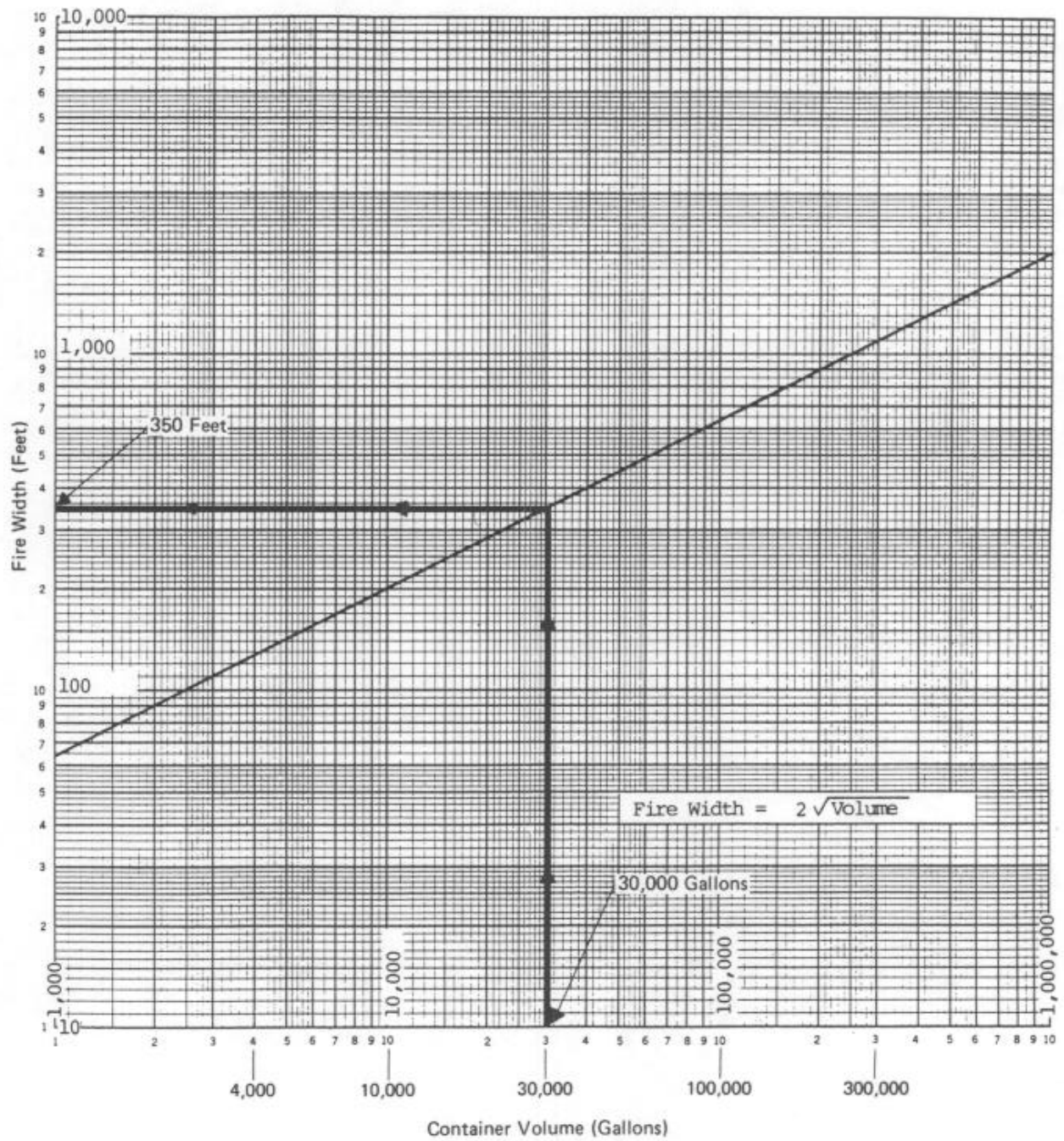


Figure 3

Acceptable Separation Distance
Hazardous Gas Container
Diked/Undiked

